2010 GSA Denver Annual Meeting (31 October –3 November 2010)

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# ROBOTIC FOLLOW-UP TO HUMAN GEOLOGICAL AND GEOPHYSICAL FIELD WORK: EXPERIMENTS AT HAUGHTON CRATER, DEVON ISLAND, CANADA

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Investigation of the use of robotic follow-up to geologic/geophysical traverses and simulated EVAs at Haughton impact crater, Devon Island, Canada demonstrates the application of this approach to geologic mapping and geophysical surveying for planetary exploration. Results indicate that robotic follow-up is well suited to: 1) testing of hypotheses generated, but not tested, during time-limited fieldwork and arising from later analysis; 2) refining and augmenting data gathered during field traverses and EVAs; 3) rote or long-duration data collection (e.g. LiDAR, Gigapan, GPR) tasks. In this experiment, a geologist and geophysicist with limited prior knowledge of the field site, but with access to a DEM, a panchromatic Quickbird image, black-and-white aerial photography, and low-resolution ASTER data were asked to plan and execute motorized field traverses that included short EVAs conducted on foot in unpressurized concept space suits. Traverses in July-August 2009 were designed to test: 1) a geologic map constructed from the remotely sensed data; and 2) for the presence of ground ice associated with gullies and ice-wedge polygons near the crater rim. Field photographs, rock samples, hand-held GPR traverses, remotely-sensed SAR data, and traverse surface roughness photographs were analyzed and the geologic map refined prior to robotic follow-up the following year. Remotely operated robotic follow-up conducted in August 2010 provided Gigapan, LiDAR, XRF, GPR and microscopic imaging for a small number of sites and locales whose careful selection was informed by all prior work. Robotic follow-up to geological mapping proved particularly valuable for evaluating the structure and morphology of the inner crater wall, mapping faults/fractures in rocks proximal to the crater rim, and understanding the target sequence stratigraphy. For geophysical survey applications, robotic follow-up provided precise metrics for quantifying volumes, depths, concentration, and large-scale distributions of ground ice. Though development of robotic protocols and field procedures is still in its infancy, this experiment demonstrates the exceptional promise of robotic follow-up to human exploration as a planetary exploration field technique.

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General Information for this Meeting

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